Space Weather Technical Forecast

Issued on Thursday, 19 September 2024 at 01:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

From the 24th of September, the way we distribute this forecast is changing and you will need to take action to continue receiving it. You should have received an email on the 4th of September explaining the steps required to do this. If you have already signed up to receive the forecast on our premium website, please disregard this message. If you haven't, or if you need help with the process, please contact moswoc@metoffice.gov.uk.

Space Weather Forecast Headline: CME influences waning. Ongoing Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity is Low with only C-class flares observed in the past 24 hours, the largest a C4.1 at 18/0344UTC from AR3828 in the southeast quadrant.

Six sunspot regions currently on the visible disc. AR3825, in the center southern disk, remains the largest and most complex region, although no significant growth has been observed. This region consists of a large trailing spot, weak intermediate spots and a compact and complex lead portion which contains at least one marginal delta configuration, it remains perhaps the most noteworthy group due to its history of X-class activity. AR3824, in the southwest, has seen both proliferation and fading of a number of spots in the intermediate and lead portions. As the region continues to rotate towards the western limb, the viewing angle will make assessment of the classification increasingly difficult. All other regions remain generally stable.

No Earth-directed Coronal Mass Ejections (CMEs) were observed on available coronagraph imagery during the period.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as observed by ACE at L1, have been highly variable, between 400-500km/s as CME influence waned. The solar wind density at below average levels. The IMF, Bt, was at weak to moderate levels around 8nT. The north-south component, Bz, varied weakly between +6 and -8nT. The phi angle was almost completely positive (away from the Sun).

Geomagnetic activity was initially Active (Kp4). Since 18/0300 UTC, activity has been Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was below the S1/Minor Solar Radiation Storm level, steadily falling close to background levels.

High energy electron flux (greater than 2MeV) observed by GOES16, generally varied on a diurnal cycle between Normal Background to Moderate levels, but are on a gradual rising trend. The associated 24-hour fluence declined steeply at the start of the period, but has increased slightly since 18/0600 UTC, recording 9.61e6 pfu at 19/0000 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of isolated M-class flares. There is a continued slight chance of an isolated X-class flare, most probably from AR3825.

Solar Wind / Geomagnetic Activity: CME influence from the arrival late on 16 Sep has now largely waned. No other CMEs feature in the current forecast.

Solar wind speeds have been highly variable, around 420-480km/s, having eased somewhat as CME influence waned. Coronal hole high speed stream influence may see solar winds remaining at slightly elevated to elevated levels into the period. In the absence of significant enhancement speeds are expected to return to slow ambient levels however.

Quiet to Unsettled (Kp 1-3) conditions expected for much of the period, however of isolated Active (Kp 4) intervals are likely and a slight chance of a G1/Minor Geomagnetic storm interval resulting from potential HSS connection.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at background. A slight chance of enhancement following any significant flaring from AR3824 and/or AR3825 persists through the period however.

High energy electron flux is expected to see an overall rising trend, returning to moderate levels with peaks at high during diurnal maximum. The forecast is uncertain, but fluence values are anticipated to slowly rise into the period, with a chance of rising above the Active threshold into Days 3 and 4 (21-22 Sep).

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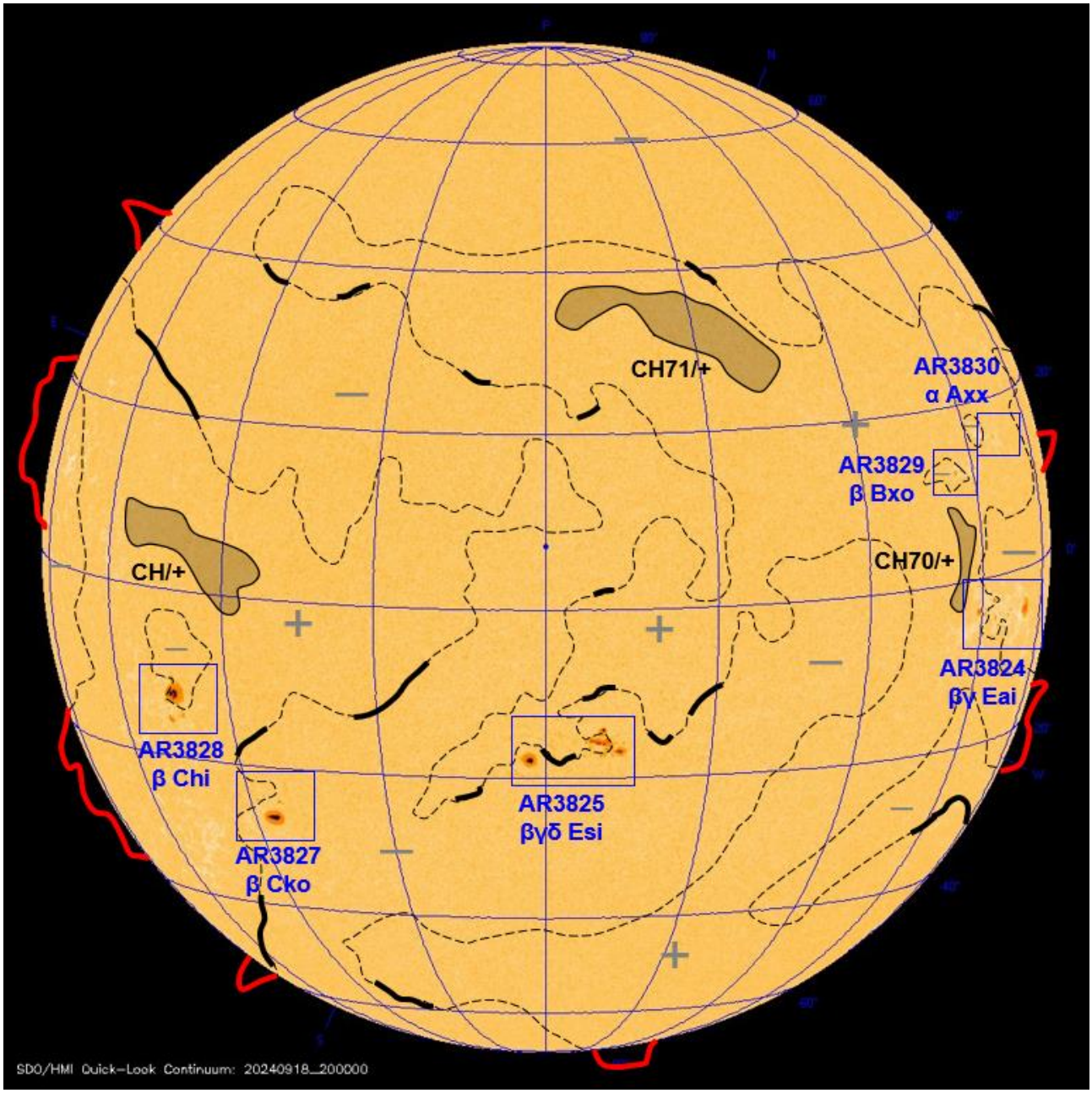
Figure 1. Solar Analysis Valid 18/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Influence from the CME arrival late on 16 Sep continues to wane, with activity falling to generally Quet (Kp 1-2) levels during the first half of Day 1. No other CMEs feature in the current forecast.

Solar wind speeds have been highly variable, around 420-480km/s, having eased somewhat as CME influence waned. A small positive coronal hole in the western disc (CH70/+) may provide some enhancement to the solar wind speeds at Earth for a time into Day 1 (19 Sep), with the larger northern hemisphere CH71/+ seeing a risk of glancing influence from Day 2 (20 Sep) onward. Influence from both of these features may see solar winds remaining at slightly elevated to elevated levels into the period. In the absence of significant enhancement speeds are expected to return to slow ambient levels however.

Quiet to Unsettled (Kp 1-3) conditions expected for much of the period, however isolated Active (Kp 4) intervals are likely and a slight chance of a G1/Minor Geomagnetic storm interval resulting from potential HSS connection.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	15	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

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Radio Blackouts - X-Ray Flares:
The bulk of the dominant active regions remain on the disc for the majority of the forecast, with AR3824 the only region passing beyond the western limb, likely later Day 2 (20 Sep). Recurrence and helioseismological mapping would suggest that smaller regions may rotate across the eastern limb during this period. The daily risk of flares is therefore held broadly constant throughout pending further developments.

Overall, a chance of M-class flares is maintained with a slight chance of X-class flares. The X-class level is maintained slightly above raw probabilities due to the history of X-class activity from AR3825.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	50	40	40
Very Active	R3 to R5 X Class	No	10	10	10	10

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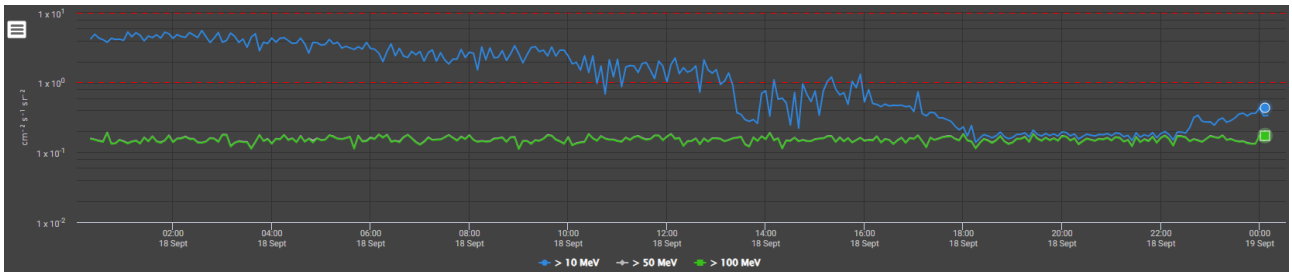
Solar Radiation Storms - (High Energy Protons):
High energy proton flux at GOES18 reached the S1/Minor Radiation Storm level during the 17 Sep but has declined and is now at near background levels. There is a chance of new enhancements during the forecast period following any significant flares, this would be more likely from AR3824 given its more favourable position in the western solar hemisphere. AR3825, in the southeast, also presents and increasing risk as a source in the event of any significant activity, having previously produced a proton response.

Overall High energy proton flux levels are expected to remain at background. A slight chance of enhancement from AR3824 and/or AR3825 persists through the period however.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	15	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 2: GOES18 24hr Proton trace



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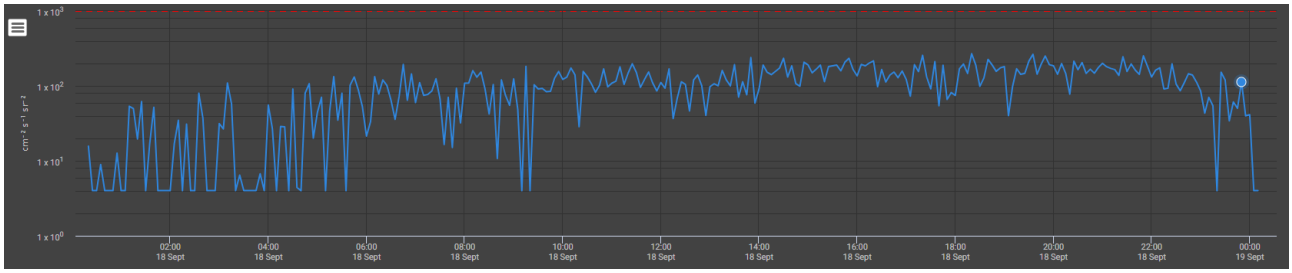
High Energy Electrons Event (≥ 2MeV):

Following the arrival of the CME late on 16 Sep, high energy electron flux levels were suppressed to background. A recovery is currently underway with fluctuations between moderate and background and an overall rising trend is expected to see the diurnal pattern return to moderate with peaks at high during diurnal maximum.
There is a slight chance that potential HSS influence into the period it may act to further suppress and delay the electron flux recovery. This lowers confidence in the forecast values into the period.

The forecast is therefore uncertain, but fluence values are anticipated to slowly rise into the period, with a chance of rising above the Active threshold into Days 3 and 4 (21-22 Sep). MOSWOC REFM is not considered to be offering significantly useful guidance given the dominance of recent CME influences.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	20	30	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: GOES16 24hr Electron Flux trace



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